

STATEMENT OF WORK

Satellite Servicing Spacecraft Bus Concept Study

Background

NASA is currently assessing the feasibility of servicing and repairing satellites in Low Earth Orbit (LEO) in order to extend their useful life. Extending the mission life of NASA and other government satellites would extend the data collection capability of the spacecraft that support national or agency missions.

NASA is considering servicing at least one national asset by mid-2018 or later to address the near-term propellant exhaustion in several Earth science missions (such as Landsat 7, Terra, Aqua, EO-1, Aura, or TRMM). This schedule is necessary to refuel the selected client prior to satellite decommissioning/de-orbit. NASA would provide the servicing payload--a robotic servicer based on the legacy of Hubble servicing and bolstered with technology developed by NASA's Satellite Servicing Capabilities Office (SSCO).

In response to an RFQ issued by NASA to study the feasibility of using existing spacecraft buses for reaching the client spacecraft, three companies showed that they had available spacecraft buses, or other vehicle for similar purpose, that could meet the SSCO's requirements. Each of the companies conducted a detailed study of the technical compatibility and interfaces between their spacecraft bus and the SSCO's Servicing Payload. These companies delivered their final feasibility study packages on 7/21/14, along with supporting documentation, including cost estimates. These studies validated that each of the three spacecraft buses was technically feasible, mature, and affordable LEO satellite servicing bus.

Scope

Under this SOW, the contractor shall mature a design for servicing Landsat 7, or a similar LEO satellite specified by NASA, with SSCO's Servicing Payload hosted on their dedicated spacecraft bus.

Requirements

The contractor shall perform a concept and technology development study in order to refine and mature a flight system architecture and concept of operations for servicing Landsat 7, or a similar satellite, with SSCO's Servicing Payload hosted on their dedicated spacecraft bus.

The contractor shall complete the following tasks to provide input for this study:

1. Provide Spacecraft Bus to Servicing Payload Interface Control Document which includes the following items:
 - a. Liftoff mass and center of gravity (CG) limits for the payload
 - b. Static and dynamic envelope available for the payload during liftoff
 - c. Minimum fundamental frequency requirements for the payload during launch

- d. Minimum fundamental frequency requirements during robotic operations
 - e. Any vehicle-induced loads such as deployment shock
 - f. Allowable interface loads between the payload and bus
 - g. Any other limits to mechanical load generation of the payload such as shock loads or launch restraints
 - h. Payload radio frequency (RF) keep-out avoidance zones
 - i. Rendezvous and Proximity Operations (RPO) to Guidance, Navigation, and Control (GNC) interface specification
 - j. Remote Interface Unit (RIU) to vehicle interface specification
2. Provide a communication system diagram that shows the proposed high gain antenna (HGA) systems design with its ability to achieve the required HGA pointing accuracy of 0.5 degrees.
 3. Provide a preliminary payload to spacecraft bus communication system encrypt / decrypt plan.
 4. Provide a preliminary communication path blockage / occultation plan.
 5. Provide your existing Payload Users Guide.
 6. Provide a preliminary mission operations plan which includes the command paths for the payload, spacecraft bus, and Restore Servicing Vehicle.
 7. Provide a preliminary Restore Servicing Vehicle bus on-orbit check-out plan, which includes major tasks and duration.
 8. Provide the primary structural loads margin for the spacecraft bus in the launch configuration.
 9. Provide the load capability for the payload to spacecraft bus mechanical interface.
 10. Provide the finite element model or stiffness for the spacecraft bus.
 11. Provide the dynamic models of the bus for both the stowed and deployed configurations.
 12. Provide the limits for payload generated shock loads.
 13. Provide a computer-aided design (CAD) model that shows the Restore Servicing Vehicle stay-out zones.
 14. Provide details on spacecraft bus locations (dimensions, cooling capacity) that could accommodate payload components.
 15. Provide vehicle contamination requirements related to a 6cc Hydrazine dispersion around the area of the client fill / drain valve and foreign object debris (blanket and wire clippings)
 16. Provide the nominal thrusting profile (thruster size, type, location, pointing vector).
 17. Provide the contamination cleanliness level requirements (beginning of life and integration and test (I&T)).
 18. Provide details (engineering modifications, cost, schedule) to implement full 6 degree of freedom attitude control.

19. Provide the results of a trade study on payload using spacecraft bus consumables (Helium and Hydrazine).
20. Provide list of common flight hardware items that your company purchases, with particular attention towards Hydrazine-related propulsion components and RF equipment and antennas (i.e., common procurements).

Deliverables or Delivery Schedule

The deliverables from this study are as follows:

1)	Concept study report	Draft: ACA + 10 weeks Final: ACA + 14 weeks
2)	Technical Interchange Meetings (3-5 days each), order determined by mutual agreement: <ul style="list-style-type: none"> • Contractor's Site • NASA/GSFC 	ACA + 4 weeks ACA + 8 weeks
3)	Cost Data for performing the mission per SSCO-provided format (compatible with Microsoft Excel)	ACA + 14 weeks

3-5 day face-to-face meetings for technical interchange between NASA and the contractor shall be held, starting the first month of the task, alternating between the contractor's site and NASA/GSFC depending upon the discussions needed. The specific subsystem discipline experts/engineers designing the interfaces shall participate in these meetings to ensure the compatibility of the design efforts of each and to review drafts of deliverables. These meetings help to refine the information to be included in the final concept study report.

All deliverables must have appropriate data rights to allow SSCO's support contractors to view and use the information to help in assessing the feasibility of the servicing mission.

Government-Furnished Information

NASA will provide the following information items in support of this study when the study contract is issued:

- Mission Level 1 requirements
- Draft of Mission Level 2 requirements
- Draft Restore Servicing Vehicle Level 3 requirements
- Servicing Payload mass and power estimates, requirements, and preliminary design
- Concept of operations
- Basic dimensions of satellites to be considered for refueling

Place of Performance

Except for attendance at technical interchange meetings, all work shall be performed at the contractor's site.

Period of Performance

The period of performance commences on the date of contractor acceptance of the terms and conditions of the contract and extends for up to 100 days.